

3.8 Energy and Natural Resources

This section presents the anticipated energy and natural resource use at the Cogeneration Project, the sources and availability of energy for the facility, the facility's impacts on energy and natural resources, and mitigation measures to be implemented.

3.8.1 Existing Conditions

This subsection provides a description of the existing conditions within the vicinity of the proposed Cogeneration Project and the energy infrastructure associated with the existing BP Cherry Point Refinery (the Refinery), some of which would also serve the proposed Cogeneration Project plant. Sources of energy and natural resources that would be utilized by the Cogeneration Project plant are also described.

3.8.1.1 Energy Sources

The existing energy infrastructure within the vicinity of the Cogeneration Project site includes electricity, natural gas, and infrastructure used by the Refinery. The local energy facilities are discussed below.

Electricity Sources

Sources of electricity in the vicinity of the project include power provided by Puget Sound Energy (PSE), by Bonneville Power Administration (BPA), and by generating facilities within the Refinery. Currently the Refinery demands approximately 85 MW of electricity.

Electricity is supplied to the Refinery by PSE through two 115-kV transmission lines that are routed within easements adjacent to Aldergrove and Blaine roads. The power lines enter the Refinery area adjacent to Blaine Road and connect to a substation within the refinery boundaries (Figure 3.8.1). In addition to this existing 115-kV transmission line corridor, a second transmission line corridor has been permitted, but not yet constructed, that extends from Blaine Road within the BP property east to connect with a BPA 230-kV transmission line.

BPA owns a major substation at Custer, Washington (4 miles northeast of the Refinery), from which point two 230-kV transmission lines are routed west and then south to the Alcoa (Intalco) aluminum smelter. The corridor from the refinery to the BPA transmission line would connect to the closer of the dual 230-kV transmission lines. The connection would be directly to the BPA transmission line on BP property, about one mile east of the Refinery.

During the winter of 2000 and into the spring of 2001, the Pacific Northwest experienced extremely high energy costs. In response to these high costs, many industrial facilities in the area either reduced production or, in some cases, ceased operation (Alcoa Intalco Works, Georgia Pacific, Bellingham Cold Storage, and others. Alcoa Intalco Works has recently resumed partial operation). In June 2001, BP installed 14 small gas-fired turbine generators to provide a measure of protection against extremely high electricity prices. The installation of these small turbines provided a more secure source of energy and at a lower cost than was available at that time. These

smaller turbines are much less efficient than the larger turbines proposed for the Cogeneration Project. In addition to being more efficient than the smaller turbines, operation of the proposed Cogeneration Project will eliminate the Refinery's vulnerability to market fluctuations.

There are two power plants in the vicinity of the Cherry Point Refinery. The PSE Point Whitehorn Power Generation Plant is located just west of the refinery. This power plant can be fired either by natural gas, diesel, or jet fuel and is primarily used for peaking power. Tenaska Power Partners operates a 249-MW cogeneration gas-fired power plant at the Phillips Refinery, and it is located a few miles south of the Cherry Point Refinery.

Natural Gas

The Northwest Pipeline Corporation, a wholly owned subsidiary of the Williams Company, owns and operates a 36-inch pipeline that transports natural gas from the Sumas gas-trading hub south through the Puget Sound area and connects with another Williams Company pipeline that originates in Colorado. BP and Alcoa jointly own the proprietary 16-inch Ferndale gas pipeline. This pipeline transports natural gas to the Cherry Point Refinery and the Alcoa Intalco aluminum smelter from the Sumas gas-trading hub.

Cascade Natural Gas owns a distribution pipeline that parallels Grandview Road adjacent to the refinery and provides gas to the PSE Point Whitehorn Generation facility. This pipeline previously transported natural gas to the Refinery until the Ferndale Pipeline was constructed in 1990.

British Columbia Hydro (B.C. Hydro) and Williams Company have formed a joint venture to construct the Georgia Strait Crossing (GSX) pipeline. The GSX Project proposal is to build a new 20-inch pipeline to transport natural gas from Sumas, Washington, to Vancouver Island, British Columbia. The proposed pipeline corridor follows Grandview Road, ~~but the exact route has not yet been approved by regulatory agencies.~~

Petroleum Products

There are several petroleum fuel pipelines located within the general vicinity of the proposed Cogeneration Project plant. The Cogeneration Project will not be connected to these pipelines.

3.8.1.2 Nonrenewable Resources

Nonrenewable resources in the vicinity of the project are primarily sand and gravel that are extracted from local sources and used locally. Currently, small amounts of sand and gravel are consumed at the refinery. Primary consumption of these resources is related to construction projects (sand, gravel, and other mineral resources as used in steel, aluminum, and other building products).

Washington State is ranked seventh in the nation in annual tonnage of sand and gravel extracted and 6 of the top 100 producers of sand and gravel in the United States operate facilities in or adjacent to Whatcom County¹. The Washington Department of Natural

¹ USGS, Mineral Industry Surveys.

Resources (DNR) is conducting a study of sand and gravel resources and recently presented findings of the report to Whatcom County².

Based on the DNR study, the largest gravel mines in Whatcom County account for approximately 68 million tons of gravel resource, including one deposit of 12.8 million tons that is currently not permitted. The total reserves, including those of the minor mines, are approximately 105 million tons. This amount is sufficient for 15 to 20 years, based on current growth projections. Construction of the Cogeneration Project is anticipated to require consumption of approximately only 0.003 percent of the available supply of sand and gravel resources within Whatcom County.

No nonrenewable resources are being extracted from the environment in the vicinity of the project.

3.8.1.3 Renewable Resources and Conservation

Renewable resources are materials that can be regenerated, such as wood, other fibers, wind, and sunlight. Neither wind nor sunlight is present at this location in sufficient, ratable quantities to make them usable for bulk electricity generation given the current state of technology.

Hybrid poplar trees used for making pulp have been planted at the BP Refinery and approximately half an acre of these trees is located on the proposed Cogeneration Project site. Although there is no specific schedule for ultimately harvesting these trees, it is anticipated that some of the hybrid poplars will be harvested to make room for the project site.

BP has a conservation program in place at the Refinery. BP has conducted both energy and water audits to find ways to conserve these resources. In addition, BP has a pollution prevention plan that identifies areas where it can conserve or reduce the amount of hazardous and other materials it uses at the Refinery. BP is committed to resource conservation and will continue to seek ways to minimize the use of both nonrenewable and renewable resources.

3.8.2 Environmental Impacts of the Proposed Action

3.8.2.1 Construction Impacts

Construction of the proposed project will require the use of both non-renewable and renewable resources, including such materials as gravel, sand, steel, glass, concrete, asphalt, paper products, and wood. The demand for these materials will be limited to the duration of the construction period, and will not be required on an ongoing basis during operation of the Cogeneration Project.

Construction will also consume electricity, water, and petroleum products. The use of other resources will continue after the Cogeneration Project plant is operational. Paragraphs below describe impacts related to the use of energy and materials during the construction phase of the project.

² Bill Lingley, Presentation to Whatcom County Council Natural Resources Committee, June 26, 2001.

Energy Consumption

Hydrocarbons

Natural or propane gas would be consumed in very small quantities during the construction process. Typical uses would be in some construction equipment and in heaters. Diesel fuel and gasoline consumption for portable generators, vehicles, and other construction equipment during the construction phase is estimated at 592,000 gallons.

Electricity

Electricity will be used for lighting and heating in construction offices, temporary lighting at the facility, and to provide power to construction equipment. The estimated electricity peak demand during construction is approximately 2.5 million volt amps (MVA) at 480 volts (V). During non-working hours, electricity consumption will primarily be for lighting for security purposes.

Nonrenewable Resources

Construction Materials and Commodities

During construction, some onsite soil will be removed and disposed of at approved sites. Various quantities of fill, including sand and gravel, will also be imported to the site. In addition, construction materials will be brought to the site including concrete, steel, and metal piping. Table 3.8-1 lists estimated quantities of these materials to be used during construction of the Cogeneration Project, including the ancillary facilities such as the gas compressor facility

TABLE 3.8-1

Construction Materials and Commodities Consumed

Material	Quantity
Imported Fill	126,000 cubic yards
Sand	7,500 cubic yards
Aggregate	18,150 cubic yards
Concrete	25,200 cubic yards
Steel	1,050 tons
Piping	130,000 lineal feet

This list does not include bulk materials included in equipment packages or systems purchased from equipment suppliers.

Acquisition of fill material and sand and gravel would be the responsibility of the construction contractor, so specific sources have not been identified, but in Whatcom County, total gravel resources that have been permitted for extraction is approximately 55.2 million tons. Based on estimates for the Cogeneration Project site, approximately 27,000 tons of gravel would be required. Therefore, no significant impacts are anticipated from the use of this resource.

Water

Water would be used for a number of purposes during construction of the project, including equipment washing, cleaning, dust control, hydrostatic testing, commissioning, and drinking. During equipment hydro testing, water consumption could peak at 600 gpm on an isolated basis. Estimated total water consumption during the construction of the Cogeneration Project is approximately ~~30.677~~ 28.7 million gallons, as summarized below in Table 3.8-2:

TABLE 3.8-2

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Construction Water Usage (Gallons)

Item	Quantity
Dust Control	7,000,000
Miscellaneous Water Use	210,000
<u>Firewater system tests and tank fill</u>	<u>600,000</u>
<u>Water treatment tests and system fill</u>	<u>140,000</u>
<u>Cooling water tests and system fill</u>	<u>75,000</u>
<u>Condensate/Feedwater tests and tank fill</u>	<u>1,650,000</u>
<u>Circulating water tests and fill</u>	<u>1,075,000</u>
<u>HRSG tests and fill</u>	<u>1,200,000</u>
<u>Steam Blows – HRSGs</u>	<u>15,500,000</u>
<u>Steam Blows – Export Steam Line</u>	<u>1,200,000</u>

*Note that these quantities do not include water required for the manufacture of concrete, since there will be no onsite batch plant.

This water will be supplied either through existing water resources at the Refinery or by the ~~construction~~EPC contractor. See Section 3.3 (Water) for more details on water use by the Cogeneration Project.

Conservation of Renewable Resources

During construction, conservation of renewable resources will take place through the implementation and use of industry standard BMPs by the selected contractor. These BMPs may include the use of energy-efficient lighting, lighting of only critical areas during non-working hours, encouraging car-pooling, efficient scheduling of construction crews, minimizing idling of construction equipment, recycling of used motor oils and hydraulic fluids, and implementation of signage to remind construction workers to conserve energy and water.

3.8.2.2 Operation and Maintenance Impacts

The Cogeneration Project is a natural gas-fired combined-cycle cogeneration facility. Its design includes high efficiency natural gas combustion turbines, a heat-recovery steam generator, steam turbine and generator, and an integrated steam system to supply the Cherry Point Refinery. Cogeneration offers major economic and environmental benefits because it turns otherwise wasted heat into a useful energy source. The main benefit of cogeneration is the more efficient use of fossil fuels when used for the generation of electricity. The efficiencies arise from the use of residual steam that would otherwise be discarded, or not used as efficiently, in the refining process of the BP facility. Thus, cogeneration eliminates the need to burn additional fuels for the sole purpose of providing steam. This reduces the overall costs of producing electricity and heat, because less fuel is consumed. (Baird, Stuart, 1993).

To better understand the economic value of varying levels of steam integration, BP conducted an alternative performance evaluation. This analysis characterized the efficiency difference between the proposed combined-cycle cogeneration plant, and a ~~similar an air-cooled~~ combined-cycle ~~generation~~ plant without cogeneration. The combined-cycle cogeneration plant scenario consists of 3 gas turbines and 1 steam turbine providing ~~both high pressure (HP) and intermediate pressure (IP)~~ steam to the Refinery. The combined-cycle plant without cogeneration has the same configuration as the above scenario except ~~it is air-cooled to minimize fresh water use and~~ no steam is supplied to the refinery. In the latter case, the gas turbine generators were operated at a reduced load (93%) so that the steam turbine exhaust would not exceed the current equipment design. The results of this evaluation determined that combined heat and power (CHP) efficiency of the cogeneration scenario was approximately ~~65.63~~%, while the stand-alone combined-cycle power efficiency without cogeneration was 53%. Net power for the cogeneration scenario was approximately ~~715.718~~-MW compared to approximately 805 MW for the non-cogeneration scenario. Although the cogeneration scenario produces less power, it is more efficient because it produces steam for the Refinery. Table 3.8-3 provides more detailed information of this comparison

TABLE 3.8-3

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Combined Heat, Power Efficiency, and Power Evaluation

DESCRIPTION Ambient Temperature 50 Degrees; Maximum Steam Throttle Rate <u>1.31MMLb</u> /Hr; Maximum Steam Exhaust Rate <u>1.37MMLb</u> /Hr.	Combined-cycle Cogeneration Plant	Combined-cycle Plant (Non Cogeneration)	
	3X1 with Steam to Refinery	3X1 no Steam to Refinery	
Gas Turbine (7FA)			
Number of Turbines	3	3	
Loading %	100	100	
Steam Turbine			
Throttle Steam, <u>kpph</u>	<u>1314</u>	1914	
Exhaust Steam, <u>kpph</u>	<u>1239</u>	2092	
Steam Balance			
Steam to refinery, <u>kpph</u>	<u>510</u>	0	
Steam Condensate from refinery, <u>kpph</u>	<u>459</u>	0	
Raw Water make-up, <u>gpm</u>	<u>-484 to -556</u>	<u>+654</u>	
Natural Gas			
Gas Turbine Generator MMBTU/Hr (LHV)	<u>4846</u>	4919	
Duct Burners MMBTU/Hr (LHV)	<u>0</u>	267	
Total MMBTU/Hr (LHV)	<u>4846</u>	5186	
Power Generation			
Gas Turbine Generator, MW	516.9	518.1	
Steam Turbine Generator, MW	<u>221.9</u>	309.8	
Auxiliary Load, MW	21.3	23.2	
Net Power, MW	718	804.7	
Efficiency			
FCP, BTU/kWh Higher Heat Value (HHV) ^a	<u>6549</u>	7151	
Combined Heat Power Efficiency % Lower Heat Value (LHV)	<u>63</u>	52.9	
Difference			
Net Power, MW	0	<u>86.7</u>	
Combined Heat Power Efficiency %(LHV)	0	<u>-10%</u>	

^a Fuel Chargeable to Power (FCP) (HHV) = (Total Heat Consumption (HHV) - (Steam Export Heat - Condensate Import Heat)/0.9)/Net Power

Electrical Energy Output During Operation

The electric power generated by the facility's four generators (3 for the gas turbines and 1 for the steam turbine) and the steam energy supplied to the Refinery is shown in Table 3.8-4 below. Note that this electric power output reflects 94% availability of the Cogeneration Project plant, which accounts for routine scheduled maintenance activities that will require taking the facility's generators offline temporarily from time to time. However, actual output may be less depending on market conditions.

TABLE 3.8-4

Estimated Maximum Annual Energy Output
(Basis: Average Ambient Conditions @ 50°F, 65% Relative Humidity and Lower Heat
Value Fuel, 94% Capacity factor)

Component	Each Train (MWh/yr)	Total (3 Trains) (MWh/yr)
Gas Turbine Generator Gross Output (172.5 MW ea.)	1,418,787	4,256,361
Steam Turbine Generator Gross Output (214 MW ea.)	1,827,213	1,827,213
Gross Power Output	3,246,000	6,083,574
Auxiliary Power Used by Cogeneration Project		146,325
Net Power Output		5,937,249
Steam Export to Refinery, MMB/yr, 600 psi, 510 MMb/hr kpph		4,200

Energy Consumption During Operation

The annual energy consumption, based on natural gas fuel, is shown in Table 3.8-5 below. Again, these data reflect 94% availability of the Cogeneration Project plant due to the need for routine scheduled maintenance shutdowns. They are also dependent upon actual output which may be less depending on market circumstances.

TABLE 3.8-5

Estimated Maximum Annual Energy Consumption
(Basis: Average Ambient Conditions of 50°F, ~~65.44~~% Relative Humidity, 94% Capacity
Factor)

Fuel Consumption	One Train	Total (3 Trains)
	MMBtu/year (LHV)	
Gas Turbine Generator (1,613.7 MMBtu/hr LHV ea.)	13,287,840	39,863,520
HRSG Duct Burners (105 MMBtu/hr LHV ea.)	864,612	2,593,836
Total Fuel (Natural Gas)	14,152,452	42,457,356

As shown in Table 3.8-4, the plant additionally consumes approximately ~~146,292~~
146,325 MWhrs of electrical energy annually during operation.

In addition to natural gas consumed for the generation of power, the project will also have electrical requirements that will consume power. There are three general facility components that consume power as shown in Table 3.8-6.

TABLE 3.8-6

Facility Power Demand

Facility Component	Power Demand
Station Power (Cogeneration Project Auxiliary Load)	17.8 MW
Natural gas Compression Station	3.5 MW
Total Project Auxiliaries	21.3 MW

^a Generally the higher the ambient temperature the greater the power demand for [air-cooling the cooling tower-condensers](#) because it takes more energy to operate the fans at a higher rate to condense the steam.

Energy Sources and Availability

Natural Gas

The Cogeneration Project will use natural gas as fuel for electricity generation. The Cogeneration Project will not have an alternative or emergency source of fuel if natural gas is not available. In the highly unlikely event that gas supplies are curtailed, the Cogeneration Project would go through a series of steps to reduce power and steam, but if the supply were completely curtailed, the Cogeneration Project and Refinery would not be able to operate. Most or all of the natural gas required for the Cogeneration Project will be supplied through the Ferndale Pipeline. The balance of the gas supply, if needed, will be transported by a third party via its proprietary pipelines. Natural gas will come from existing Canadian sources via the connection with the Westcoast Energy Inc. pipeline at Sumas, Washington. From there, gas is transported in the Ferndale pipeline, which is majority owned by Arco Western Gas Pipeline Company (a BP company), to Cherry Point.

Two interstate natural gas transmission pipelines, the Northwest Pipeline (Williams Company) and the Gas Transmission, Northwest (PG&E) serve the Pacific Northwest. Natural gas from Canada and the Rocky Mountain region is delivered to customers in the Northwest and other western states through these pipelines. Utilities, industry, and gas market traders purchase capacity on these natural gas transmission lines to transport natural gas to their end user.

About 80 percent of the natural gas used in the Northwest comes from Canada, but the Northwest Pipeline can deliver gas to northwest Washington from both the Rocky Mountains and from Canada. Canada's natural gas reserves are found primarily in the Western Canada Sedimentary Basin of British Columbia, Alberta, and Saskatchewan. In a recent report from the Canadian National Energy Board³ it estimated that 271 trillion cubic feet is recoverable. At current rates of production in Canada, this is approximately a 50-year supply. In addition to these sources, other reserves are being discovered using new technologies and many areas remain unexplored.

The source of gas for the Cherry Point Cogeneration Project is the Sumas gas-trading hub, which is served by both the Westcoast pipeline and the Northwest pipeline. This

³ Canadian Energy, Supply and Demand to 2025

huge gas delivery system serves southern British Columbia's and western Washington's current and future natural gas needs. The impact of the Cherry Point Cogeneration Project on this supply is negligible considering the supply capability of these pipelines.

Furthermore, ample gas supply exists in Alberta and the Rocky mountains; upgrades to these pipeline systems are possible and gas availability will be a consequence of market forces rather than natural gas supply constraints. The Cherry Point project will use less natural gas per kWh than state-of-the-art merchant plants that are not cogeneration facilities, and therefore will have less of a demand on the existing system than comparable merchant plants.

The Cogeneration Project is not expected to affect the availability of natural gas to other users in northwest Washington. The Cogeneration Project's relatively small gas requirement compared to the gas supply that can be delivered to the area, and the existence of competitors to deliver additional gas from different supply regions help ensure no price impact from the incremental Cogeneration Project.

Natural gas exported from Canada to the Northwest and other western states utilizes either the Westcoast Energy, Inc. pipeline that transports gas through British Columbia to the border at Sumas, Washington, or through Alberta on the Alberta Natural Gas Pipeline (TransCanada) to the border at Kingsgate, British Columbia.

Future pipeline projects that would increase supply of natural gas to northwest Washington include the proposed:

- Looping of the existing Northwest Pipeline by Williams Inc.;
- Looping of Westcoast Energy Inc.'s Southern Mainline Transmission System, which crosses the Canada/ U.S. border at Sumas, Washington, to increase overall system capacity in Washington State; and
- Construction of the Georgia Strait Crossing (GSX pipeline) being proposed by B.C. Hydro and Williams, which would extend westerly across Whatcom County parallel to Grandview Road and across the Strait of Georgia to Vancouver Island, British Columbia.

Other recently constructed natural gas pipelines in British Columbia, which could be available to supply natural gas to northwest Washington, include BC Gas Utility Ltd.'s (BC Gas) Southern Crossing 24-inch mainline transmission pipeline which extends from Yahk in the East Kootenays to Oliver in the southern Okanagan of B.C., over a distance of approximately 185 miles. This mainline transmission pipeline was commissioned in November 2000.

Electricity

The Cogeneration Project unit will supply its own electricity needs from an auxiliary bus fed from its own generators. For initial startup power or to restart the entire cogeneration unit, power can be back-fed from the BPA system. The Cogeneration Project unit will minimize electricity use in order to maximize efficiency.

Electricity will be exported from the site through the BPA transmission system with the interconnect to the BPA Custer substation. BPA is in the process of conducting a system impact study and a facilities study to determine what, if any, additional upgrades would

need to occur on the system to accommodate the power generated by the Cogeneration Project. Information regarding the potential impacts to the BPA system will be provided to EFSEC when the information is available.

Petroleum

The project will use petroleum products, primarily lubricants in the operation of the facility and a minor amount of gas and diesel fuel in the operation of vehicles around the facility. Petroleum products are available from commercial outlets in the vicinity of the project. The use of petroleum products by the Cogeneration Project is not expected to have a significant impact on the availability of petroleum products.

Nonrenewable Resources

Natural Gas

The primary nonrenewable resource consumed during operation would be natural gas. As mentioned above, an estimated maximum of ~~42,059,634~~ 42,457,356 MMBtu/year of natural gas would be used, assuming 94% availability of the Cogeneration Project plant. Actual quantities of natural gas consumed may be less depending on market circumstances. Based on recent studies on the availability of natural gas from Canadian gas reserves and estimates of future reserves the impact on future use and demand for natural gas is not considered significant (see the Energy Sources and Availability section above).

Water

Whatcom County PUD District No. 1 (PUD) and Alcoa have agreed to make recycled non-contact once-through cooling water from Alcoa's nearby aluminum smelter available for use at the Cogeneration Project. The PUD would provide 2,780 gpm of recycled cooling water to the BP. The Cherry Point Cogeneration plant would utilize this recycled water for its non-potable water needs, including an air-cooled condenser with 45a conventional cooling tower design with 12 cells to dissipate heat in the operation of the facility. The Cogeneration Project would require an average of 2,244 to 2,316 gpm of industrial water. On average, 484 to 556 gpm of recycled cooling water would be available for use at the Refinery, reducing the need for water to be withdrawn from the Nooksack River, and reduce water demand.

The Birch Bay Water and Sewer District would provide potable (treated) water for use by the Cogeneration Project under an existing agreement with BP. The amount of potable water required for operation of the Cogeneration Project is expected to average between 1 and 5 gpm. The District currently purchases water from the City of Blaine.

However, water would be required for makeup requirements of the steam cycle and for general purposes, including potable water for employee consumption. The Process Flow Diagram Heat and Material Balance, Base Case Scenario, shows a total raw water make up of 604 gallons per minute (gpm) on a continuous basis. Of this total, there is only a net increase of about 40 gpm required by the Cogeneration Project. The remaining 564 gpm offsets refinery consumption that is currently being processed in existing refinery water treating equipment. Industrial Water Reuse is also being considered as an alternative to air-cooled condensers. If feasible, this option would also minimize the net demand for raw water.

~~The project will also result in an overall reduction in the Refinery's water consumption because the Cogeneration Project plant will produce steam instead of water being heated in the Refinery's boilers. Combined with the proposed water reuse project whereby HRSG blowdown water would be routed to the Number 2 Cooling Tower, there will be a net increase in water consumption from Whatecom County PUD of only 40 gpm.~~

~~The use of water by the Cogeneration Project, with air cooling, represents a significant reduction in water demand as compared to a gas-fired combined cycle project using conventional water-cooling technology without water reuse. The small water increase required by the project, relative to the overall water authorized supply from the Whatecom County PUD #1 of 11 mgd (Tom Anderson, General Manager Public Utility District, Whatecom County PUD #1, pers. comm., January 2002), together with the current water demand by the Refinery, are not considered significant.~~

Conservation and Renewable Resources

This section describes the conservation measures and renewable resources that will be used during operation of the Cogeneration Project. The proposed Cogeneration Project incorporates significant conservation measures that are further described below.

Cogeneration of electricity and steam maximizes the use of combustion energy from the source fuel, in this case natural gas. The use of large, state-of-the-art turbines fueled by natural gas is currently the most thermally efficient way to produce electricity from hydrocarbon fuels. When gas turbines are used in combined-cycle mode, cycle thermal efficiencies of about 53% are typical (as shown in Table 3.8-3). By contrast, thermal efficiencies for conventional coal or gas-fired steam power plants are typically in the 30-40% range. Cogeneration cycle efficiencies exceed the efficiency of combined-cycle gas turbine plants because cogeneration units more fully utilize fuel heat of combustion.

With the addition of using the Cogeneration Project's residual steam in the refining process, the overall efficiency increases significantly. Table 3.8-3 shows that through cogeneration, overall efficiency of the combined-cycle Cogeneration Project is 65.63% as compared to 53% for a comparable combined-cycle facility that does not utilize the steam. This represents an increase in efficiency of about 12.10%, which represents a significant increase in maximizing the available energy in the natural gas.

In other words, through the use of the Cogeneration Project at the BP Refinery, older less efficient boilers can be taken out of service, which represents conservation in the use of natural gas. BP also installed less efficient small combustion or gas turbines in response to the extremely high energy costs that occurred during the winter and spring of 2001. The Cogeneration Project will make it unnecessary for the Refinery to maintain small generators or turbines.

Water

The Cogeneration Project proposes to use air-cooling~~conventional water based evaporative cooling~~ to dissipate the heat from the steam. ~~which results in a significant conservation of water over conventional water-cooling technology (cooling towers). The air-cooled technology uses no water to dissipate the heat, while a similar size plant utilizing water-cooled technology would use 4.32 mgpd (3,000 gpm). However, BP is committed to evaluating further water conservation methods such as~~ The cooling tower

will require makeup water to replace evaporative losses. It will use recycled once-through cooling water from the nearby Alcoa aluminum smelter. On average, the Cogeneration Project will use 484 to 556 gpm less than the recycled cooling water available. The excess recycled water will be used at the Refinery, reducing the amount of water needed to be withdrawal from the Nooksack River. of Cogeneration Project wastewater in existing Refinery operations.

Land Resources

BP is committed to conserving, to the degree possible, land resources, including wetlands within its Cherry Point property. The siting of the proposed Cogeneration Project facility involved the evaluation of several sites to minimize impacts on land resources and maintain the industrial activities within a confined area. BP has also identified land within its ownership (north of Grandview Road) that has significant potential for environmental protection and, as appropriate, enhancement. This area is proposed for wetland mitigation efforts as the result of impacts at the selected Cogeneration Project site. See Section 3.4 for more information on wetlands. By concentrating industrial development in specific areas, it avoids fragmentation of habitat. When mitigation efforts are focused and developed in key areas, existing habitats can be linked, increasing the overall benefits of both the mitigation and the existing habitat. Through these efforts, BP can conserve and minimize the area for industrial development, while minimizing impacts, enhancing and preserving higher quality environmental areas.

3.8.3 Environmental Impacts of the No Action Alternative

Resource Conservation

The Cherry Point Cogeneration Project plant is the most efficient natural gas-fired electricity generating facility ever proposed in Washington State. The Whatcom PUD will provide recycled cooling water for the Cogeneration Project's water requirements. Additional recycled cooling water could be used by the Refinery. Its location next to the Cherry Point Refinery allows it to offset almost all of the water needed by the project Under the no action alternative, other merchant power plants would be built in the Pacific Northwest to help meet the region's electricity needs. These plants would:

1. Use up to 10% more natural gas to create the same amount of electricity;
2. Require significantly greater volumes of water, particularly if they use water-cooled technology rather than air-cooled technology, and if they are unable to reduce water consumption by re-using or recycling process water as proposed by the Cherry Point Cogeneration Project; and,
3. Require Cherry Point Refinery to continue to run its boilers, which would continue to require both natural gas and water.

The “no action” alternative would result in construction of generating plants, which would consume more resources to generate the same amount of electricity as the Cogeneration Project.

Resource impact

The Cherry Point Cogeneration Project site is a buildable site adjacent to an existing industrial facility and requires no new offsite natural gas pipelines, water pipelines, or high voltage power lines. Voltage stability issues and projected demand growth in the Puget Sound region will require either additional generating capacity in this area or additional high voltage transmission line capacity from central Washington. Under the no action alternative, other power generation projects could be sited to serve this load or additional transmission lines could be built. Most other generating plant locations lack the ready access to all required infrastructure, and new transmission lines would impact resources over a wide area. It is likely these projects would impact resources over a larger area than would the proposed Cogeneration Project project.

3.8.4 Mitigation Measures

The following mitigation measures have been identified to reduce the impacts on energy and natural resources. Some of these mitigation measures have been identified as mitigation for impacts on other resources.

- [Air-coolingWater reuse](#) is a mitigation measure to reduce [fresh](#) water consumption. ~~Industrial water reuse would also be considered a viable alternative.~~
- Existing, less-efficient gas turbines and boilers would be taken out of service and replaced with more efficient turbines, reducing air emissions.
- Siting the Cogeneration Project in close proximity to the Refinery conserves rural, agricultural, and environmentally desirable land resources.
- Cogeneration is a more efficient use of natural gas energy by producing steam for the refinery relative to a combined-cycle cogeneration plant without cogeneration capability.

3.8.5 Cumulative Impacts

As indicated above, other proposed projects within the general vicinity of the Cogeneration Project include looping of the existing Northwest Pipeline by Williams Inc., and construction of the GSX, which would parallel the Grandview Highway corridor. The other pipeline looping project mentioned above, Westcoast Energy's Southern Mainline Transmission System, is planned to be undertaken on the Canadian side of the border and will not require construction of new pipeline on the U.S. side of the border, although it will result in increased system capacity to Washington. Westcoast Energy Inc. has recently applied to the Canadian National Energy Board (NEB) for approval to construct this looping project.

Aside from these proposed pipeline projects, no other industrial, commercial, or residential projects are planned within the general vicinity of the Cogeneration Project that could result in cumulative or synergistic impacts on biophysical, cultural, and infrastructure resources, beyond those which will be mitigated for by BP's proposed Cogeneration Project.

If construction of these pipeline projects is undertaken at the same time that the Cogeneration Project is constructed, there could be potential cumulative impacts on some of the nearby natural resources such as wetlands and associated wildlife habitats, as well as on existing transportation and community infrastructure.

Although construction and operation of the proposed Cogeneration Project will be designed to minimize or avoid potentially adverse impacts to biophysical and cultural resources, as well as existing community infrastructure, as described in detail throughout this application, BP will endeavor to coordinate its activities with other industries and proponents to further minimize the magnitude or duration of potential cumulative impacts.

Construction and operation of the Cogeneration Project are unlikely to impact available supplies of existing natural gas, water, electricity, sand and gravel, or other non-renewable natural resources within Whatcom County.

Natural Gas

Based on information provided above, there are sufficient gas reserves in North America to supply the proposed Cogeneration Project and other existing and planned natural gas-related projects throughout Washington State such that the overall effect on available supplies would be negligible.

As indicated above, approximately 271 trillion cubic feet of known natural gas reserves are recoverable, which are predicted to provide a 50-year supply of gas to consumers.

The Cherry Point project is unique in that it will use less natural gas per kWh than state-of-the-art merchant plants, and therefore will have less of a demand on the existing natural gas resources than comparable merchant plants. The Cherry Point Cogeneration Project is not expected to affect the availability of natural gas to other users in northwest Washington.

Energy Use

The project would consume energy by combusting natural gas and using electrical power at the project site. However, the cogeneration technology is the most efficient form of converting hydrocarbons to power. ~~The air-cooling~~Conventional cooling tower technology is ~~an efficient energy intensive and does result in more energy consumption than other~~ heat dissipation ~~technologies technique that also minimizes.~~ ~~However, the overall cumulative impacts of energy use are not significant compared to the total amount of energy being produced-consumed~~ by the proposed facility.

Sand and Gravel

Sand and gravel would be used in the construction of the Cogeneration Project facility. The total resource of gravel in Whatcom County is estimated to be 105 million tons and this is sufficient for approximately 15 to 20 years under current growth rates in Whatcom County. The proposed project would utilize less than 0.003% of the total estimated gravel reserves in Whatcom County.

3.8.6 Significant Unavoidable Adverse Impacts

No unavoidable significant adverse impacts on energy and natural resources have been identified.